Decision (June 2023) 50(2):233–249
https://doi.org/10.1007/s40622-023-00352-1

RESEARCH ARTICLE

A survey on willingness-to-pay for food quality and safety cues on packaging of meat: a case of Poland

Anna Walaszczyk · Aleksandra Kowalska · Iwona Staniec

Accepted: 24 July 2023 / Published online: 5 September 2023

Abstract Since meat is an important source of protein needed for human development across the world, responsible production and consumption of meat products with a food quality and safety scheme label is one potential option to maintain social, economic and environmental sustainability. The implementation of this option depends on high willingness-to-pay (WTP) for certified safe foods among citizens. The overarching aim of the study is to examine WTP for national food quality and safety cues on the packaging of meat products. Using a questionnaire on-line survey of 1000 individuals, this study examines relationships between demographic variables and WTP for certified meat products. Relatively younger and higher-income consumers living in households composed of 4 and more members, which are the decision-makers of the future, are most willing to pay a premium price for guaranteed quality meat products. The strongest predictor of WTP for certified quality meat is the number of household members which can be related to children raising and care. A choice of guaranteed quality meat products is putting into practice "less but better" meat approach which tackle sustainable challenges of meat production and consumption regarding issues related to animal welfare, human health and environment.

Keywords Meat products · Food safety · Food quality schemes · Willingness-to-pay · Sustainable production · Responsible consumption

A. Walaszczyk
Institute of Marketing and Sustainable Development, Faculty of Organization and Management, Lodz University of Technology, Wolczanska 221 Street, 93-005 Lodz, Poland

A. Kowalska (✉)
Institute of Economics and Finance, Maria Curie-Sklodowska University, Pl. Marii Curie-Sklodowskiej 5, 20-031 Lublin, Poland
e-mail: aleksandra.kowalska@mail.umcs.pl

I. Staniec
Institute of Management, Faculty of Organization and Management, Lodz University of Technology, Wolczanska 221 Street, 93-005 Lodz, Poland

Introduction

Food production, primarily meat production, is one of the most environmentally impactful areas of human activites (Poore & Nemecek 2018). Since meat is an important source of protein needed for human development across the world, responsible production and consumption of meat products with a Food Quality and Safety Scheme label is one potential option to maintain social, economic and environmental sustainability. The fundamental point is that food security and sustainable development will only be ensured when

the available food (in particular meat products) is compatible with the faith and culture of its recipients.

Food safety is a key element of its quality. Unsafe food cannot be placed on the market in accordance with the provisions of law (Kowalska & Manning 2021). As a general rule, it can be assumed that people would not buy and consume unsafe food if they were aware of it. While a broad range of scientific literature have dealt with the issue of food safety, there is no consensus on the definition of this term. Food safety issue has the closest relationship to the obligation of the European Union Member States (EU MSs) or other countries to protect consumer health and life. Although, Kowalczyk (2016) claims that food safety should be ensured with respect to human health but also to consumers' economic and social interests. Food adulteration often prejudice consumer interests, and potentially poses a threat to her/his health and/or life. The purchase of adulterated food means gaining inequivalent value in use in relation to the cost of purchase (Kowalczyk 2016; Kowalska 2019). Food safety is described in ISO 22000: 2018 as the concept that food will not cause an adverse health effect for the consumer when it is prepared and/or eaten in accordance with its intended use, that is, a term encompassing both intentional adulteration and unintentional contamination (Manning & Soon 2016). The position of the Global Food Safety Initiative is that food defense is a subset of food safety issues where the adulterant has the potential to cause harm and is a separate problem where the agent is nonharmful (GFSI 2013). Some consumer studies refer to the perception of food safety and deal with the question of how this perception influence consumer decision-making (individual preferences, willingness-to-pay for added safety features etc.) (Grunert 2018; Liu et al. 2020; Vainio et al. 2020).

Food quality is about meeting the expectations of end consumers. Cardello (1995) perceived food quality as "a consumer-based perceptual/evaluative construct that is relative to person, place and time". Schröder (2003) pointed out that food quality is about delivering food that satisfies. In accordance with the Kaizen philosophy, food companies should continuously undertake efforts to improve food quality, particularly that consumers' preferences have been changing rapidly in recent years. The constant improvement of performance is a condition for success in highly competitive food market. When we asked the citizens of one country if this was high quality food, we would get a broad range of various answers and all the respondents would be right. A foodstuff is considered either safe or unsafe in one particular country in line with the requirements laid down in food law.

Food safety assurance is fundamental for effective food quality management (Kowalska 2019), hence, food safety may be regarded as subordinate to food quality. However, Roy and Srivastava (2021) suggest that these concepts might be developed parallely, noting that "food safety and food quality jointly reorient the basic landscape of intra- and inter-firm governance". Consequently, the position of consumers in the food system is growing. They have been more and more interested in quality food in the past decades (Verhaegen & Huylenbroeck 2001; Dimara & Skuras 2005; Marscarello et al. 2015) whereas farming, manufacturing, distribution, marketing, sale and consumption of quality foods often contribute to reconciling the interests of various parties. These include farmers and manufacturers (creating added value), consumers (satisfaction and health issues) and citizens (environmental and local development concerns) (Verhaegen & Huylenbroeck 2001).

Quality food products are often labelled with abbreviations and symbols referring to the quality schemes. In Poland, there are global, EU or national quality schemes for agricultural products and foodstuffs. This way consumers may learn about food attributes, important for their purchase decisions, through quality signaling in the form of informational labeling, certificates or warranties. Credence attributes which rely on trust determine the specific nature of quality products. Above all, however, each food product is characterized by search attributes that can be researched by the buyer before purchasing the product, and experience attributes which can be assessed at the time of purchase, preparation or consumption (Aboach & Lees 2020; Dimara & Skuras 2005; Manning & Kowalska 2021; Walaszczyk et al. 2022). It is worth noting that food consumer relies on his/her own trust and the general trustworthiness of people (general or social trust) which influence the specific and relational trust in restaurants (Javed et al. 2021), producers, retailers or food products. Food quality labels enable to transform credence attributes into search attributes, and then verifying credence

characteristics is institutionally supported via certification or regulatory standards (Fernqvist & Ekelund 2014; Verbeke et al. 2013). Such labels (as being extrinsic quality cues) may positively influence both objective and subjective quality of food products. Objective quality is based on technical aspects of the product (often defined in the provisions of law), and is of particular interest of food control and audit institutions, but also food businesses. Subjective (perceived) quality is based on consumers' judgements and is important for food business operators and some public sector bodies (e.g. kindergartens in Poland) which compete for clients (Konuk 2019) also, in a way that benefits customers (their health and life).

Kitz et al. (2022) found that over half of the Canadian consumers have become more concerned about food safety during the COVID-19 outbreak, and every other resident of Canada have become more price conscious when buying groceries during a time of economic recession caused by the pandemic. Based on a survey run in the US, Meixner & Katt (2020) have also suggested that food safety concerns have become more important during the pandemic. While increased food safety consciousness has brought higher willingness-to-pay (WTP) for certified safe foods among citizens of both developing and developed countries, e.g. Ghana (Amfo et al. 2019), China (Liu et al. 2020), Germany and Great Britain (Lewis et al. 2017), there is a fear that high inflation rates, together with increased price consciousness, might translate into a decrease in WTP for a value added to a food product, e.g. sustainable cues on packaging, food quality/safety cues on packaging, environmentally responsible packaging (Kitz et al. 2022).

In Poland, the issue of WTP in relation to certified meat products in the context of national food quality systems has not been investigated. The number of publications referring to the WTP index to other areas related to the food industry is also small (Table 1).

Due to the limited number of studies on WTP for food in Poland and the lack of research on the impact of the certificate of conformity of meat production with the requirements of national food quality systems on the willingness of consumers to pay a higher price, a questionnaire on-line survey of 1000 individuals from Poland was conducted in 2022. The overarching aim of the study is to examine the willingness-to-pay (WTP) for national food quality and safety cues on the packaging of meat and meat products.

The next section of the article develops the conceptual background and presents hypothesis which create a general research framework; then the methodology employed and demographic structure of the sample are presented; the results of the survey of Polish consumers are analyzed and discussed; finally, conclusions are provided, and implications, which should be of value to academics and business people operating in food industry in developed countries, are drawn. There is also an attempt to frame the development of future empirical research.

Conceptual background and hypothesis development

The average consumer makes many nutritional decisions every day (Corallo et al. 2021), mostly unconsciously (Chambers et al. 2015) — under the influence of cognitive and emotional problems (Grabenhorst et al. 2013). Thus, several factors influence people's food choices, including health, cost, convenience, taste (Bublitz et al. 2013; Furst et al. 1996), and personal and environmental safety (Bagozzi et al. 1990). Additional nutritional value for consumers comes from animal welfare (Grunert et al. 2018; Schröder et al. 2004), environmental protection (Massey et al. 2018; Thøgersen 2009) and social responsibility (Feldmann et al. 2015). The findings of Kaya (2016) confirm the impact of socio-economic and demographic variables on consumer knowledge and attitudes.

Recent food scandals have caused consumers to question the quality of foodstuffs (Konuk 2019). The outbreaks of infectious animal diseases, such as Bovine Spongiform Encephalopathy, Avian Influenza and Foot and Mouth Disease had a significant influence on the laws passed by the EU over the period 2002–2004. This time, the EU food law started to focus on food safety issues and protecting consumers. The mandatory animal identification and traceability system was introduced in the EU which led to an increase in consumer confidence in animal-based products (Charlebois et al. 2014; Korzycka & Wojciechowski 2017). Furthermore, meat and meat products are one of the most common targets for adulteration in Poland and other countries for economic, socio-cultural and technological reasons (Kowalska 2020; Soon & Abdul Wahab 2022). Meat

Table 1 Review of publications in Poland in the field of WTP in the food industry

Author(s)	Year of publication	Research object	Major conclusions
Kaczorowska et al. (2018)	2018	Fruit	The purchase of organic fruit at a higher than average price is prompted by the certificate
Kozłowski et al. (2018)	2018	Ice cream	WTP for socially responsible products is higher in the case of altruistic buyers
Witek(2018)	2018	Eco food	WTP is an important predictor of the decision to purchase an organic product
Olewnik-Mikołajewska et al. (2016)	2016	Products of animal origin	Polish consumers are willing to pay more for products with a high health value than for specific products with "increased nutritional value"
Sajdakowska et al. (2016)	2016	Yoghurts	Despite consumers attaching great importance to health and declarations of WTP a higher price for selected health benefits of yoghurt, the price levels they accept are not too high
Żakowska-Biemans, (2016)	2016	Traditional sausages	There are regional differences observed in acceptance and WTP for innovative variants of Kabanos. In general, consumers in Warsaw are more inclined to pay more for innovative variants of Kabanos than consumers in Cracow
Sajdakowska et al. (2014)	2014	Innovative food products	A higher level of product acceptance was positively correlated with higher WTP declarations

Source: own study based on a review of research results

has a significant position in food consumption patterns and commands high prices, furthermore, consumer is not able to detect meat substitution (Kowalska 2019). As meat production and consumption is faced with increasing ethical concerns regarding animal welfare and environmental impacts, consumers are nowadays using quality cues to aid in their purchasing decisions (Aboach & Lees 2020).

In Poland, there are three food quality systems relating to meat and meat products. These are:

- Pork Quality System (PQS) — including requirements for pork meat,
- Quality Meat Program (QMP) — including requirements for beef,
- Quality Assurance for Food Products (QAFP) — covering requirements for pork, poultry and cold cuts.

National food quality systems are recognized pursuant to Art. 15 **sec. 2 of the Act of February** 20, 2015 on supporting rural development. Pursuant to this provision, the minister responsible for rural development recognizes, by means of an administrative decision, food quality systems (including QAFP, QMP, PQS) if the following criteria are met: (1) the specificity of the final product produced by the scheme results from a clear requirement to guarantee any of the following: — specific product features, — specific methods of cultivation or production, or — a quality of the final product that significantly exceeds the marketing standards for the product in question in terms of public health, animal or plant health, animal welfare or environmental protection; (2) the system is open to all producers; (3) the system includes binding product specifications and compliance with these specifications is verified by public authorities or an independent inspection body; (4) the system is transparent and ensures full traceability of products.

Presenting the characteristics of individual national food quality systems in Poland (Walaszczyk 2016) — the PQS system is based on the selective selection of domestic pig breeds and identified animals, as well as defines the requirements related to their proper nutrition. The detailed and rigorous requirements of the PQS system allow for the preservation of high-quality pork without the use of artificial additives and dyes. The QMP system is a set of rules defining the entire beef production process, from indicating the breeds of cattle for the best meat, to the method of its packaging and labeling. The quality of

beef and young beef produced under the QMP system results from the detailed obligations of livestock producers, which guarantee the characteristics of the production process, in particular: selection of appropriate breeds for the production of qualified animals, handling of animals, application of fattening recommendations. The QMP system also defines standards for the transport of animals and the way they are handled in slaughterhouses. The QAFP system includes both vertical and horizontal requirements which are verified in the food chain. The purpose of developing and implementing the QAFP system is to harmoniously link the requirements and criteria in a horizontal and vertical system for the links in the production chain of high, guaranteed quality agri-food products — in relation to various types of meat, at various stages of its processing. Currently, with differences between the scopes of the systems, only PQS and QAFP (in its pork section) can be directly compared. When it comes to the detailed obligations of producers of live pigs, the PQS does not go beyond the solutions proposed in the QAFP (Krzyżanowski 2017). Graphic marks of national food quality systems (QAFP, PQS, QMP, presented from left to right) relating to the meat sector are shown in Fig. 1.

Source: qafp.pl, qmpsystem.eu, polsus.pl.

The research problem of this study is to present factors determining Polish consumers' willingness-to-pay a higher price for meat products, safety and quality of which are confirmed by the manufacturer with appropriate labeling on the packaging of the products. The labeling considered in this study consists of food quality and safety cues on meat product packaging which are the result of the granted certificate of conformity with National Food Quality Systems in Poland, such as PQS, QMP and QAFP.

The use of the WTP method leads to obtaining feedback from consumers about the amount they are willing to pay for a given product or service. A number of WTP measurement methods are used for this purpose, which can be distinguished by whether they measure the WTP directly or indirectly, and whether they measure the hypothetical or actual value of the consumer's WTP (Anderson et al. 1993). Some researchers favor a direct approach, asking consumers to provide their WTP for a specific product through the use of open-ended questions. Others choose an indirect approach based on a series of analyses, where the WTP is calculated based on consumers choices among several alternative products and the "none of these" option (Miller et al. 2011; Wertenbroch et al. 2002). However, both direct and indirect approaches may produce inaccurate results. Breidert et al. (2006) have pointed out that knowledge about willingness-to-pay a premium price for a product plays a crucial role in many areas of marketing management like pricing decisions or new product development.

Demographic factors influence WTP for a value added to a food product by means of a food quality and safety cue. Amfo et al. (2019) showed that young, well-educated and high net-worth individuals from Ghana are more likely to pay a price premium for certified vegetables. Marscarello et al. (2015) found out that socio-demographic features of Italian consumers influence their perception of food quality. Liu et al. (2019) examined WTP and its potential demographic determinants, and proved that age, education, and income of Chinese people were predictors of WTP for a specific technology. There is an evidence that age, education and income affected Chinese consumers' WTP for attributes of pork related to quality management system certification (Hou et al. 2019). Thus the degree, strength and direction of the association between demographic factors and WTP for certified meat products is explored in our study and we submit the following hypotheses:

Hypothesis 1 There is a relationship between gender and WTP for certified Polish meat products.

Fig. 1 Marks of national food quality systems in Poland for the meat sector

Hypothesis 2 There is a relationship between age and WTP for certified Polish meat products.

Hypothesis 3 There is a relationship between place of residence and WTP for certified Polish meat products.

Hypothesis 4 There is a relationship between level of education and WTP for certified Polish meat products.

Hypothesis 5 There is a relationship between number of household members and WTP for certified Polish meat products.

Hypothesis 6. There is a relationship between self-reported economic status of household and WTP for certified Polish meat products.

Methodology and characteristics of the respondents

The study was carried out in the period January—March 2022 among Polish consumers. Empirical research was conducted using a web-based survey questionnaire (CAWI, Computer-Assisted Web Interview). The survey questionnaire, which is a research tool, was developed on the basis of the methods of examination of WTP proposed by Wertenbroch et al. (2002) and Miller et al. (2011). The research questionnaire consisted of three sections: (1) the respondent's personal data, including questions about gender, age, place of residence, education, number of people in the household and assessment of the household's financial situation, (2) explanation of the terms: PQS, QMP, QAFP (together with graphic symbols) and certification, (3) declaration of willingness-to-pay a higher price for a certified meat product. The electronic version of the survey (programmed interview) was placed on the server of the company which commissioned the survey. It was the CADAS server dedicated to CAWI research with access to approximately 1,800,000 panelists in Poland. A www link was generated, which was used to send invitations to the study. An over-sample and quotas for individual demographic variables were set. It was possible to track information on the number of completed interviews, surveys being completed, interrupted and rejected at the control stage (implementation control in accordance with the ESOMAR and PTBRIO standards) on an ongoing basis. When one of the quotas was full, the possibility of completing the survey by a person with these characteristics was blocked.

The study used self-report tools to measure variables. The questionnaire survey involved selecting measurement tools to assess the variables of interest to the researcher and then reaching out to respondents to ask them to answer the test items presented. All variables—independent and dependent—were measured using a common measurement method. The respondent answered the test items of the entire set of questionnaire during one session. Only respondent-identifying characteristics (obtained from the respondent in the same survey) and one measurement variable were used in our study. Therefore, a procedural limitation was applied regarding the presence of common method error (Podsakoff et al. 2012).

Statistical analysis was performed using the IBM SPSS Statistics 25 package. Chi-square test was used to determine whether two classification criteria are independent of each other (Table 2). In order to assess the strength of the relationship between the analyzed nominal variables, Cramer's V coefficient was used. Urbanowska-Sojkin (2013) gives the following ranges for Cramer's V strength: < 0–$0.3 >$ indistinct, $(0.3$–$0.5 >$ clear, $(0.5$–$0.7 >$ medium, $(0.7$–$1 >$ strong.

When statistically significant differences were confirmed, an appropriate post-hoc test was used. In this way, it was possible to check statistically significant differences between groups. The selection was made on the basis of the homogeneity of variance in the compared groups of people. The strength of the effect was measured by the eta-squared coefficient. When comparing two groups of respondents, the Mann–Whitney U test was used (Wall Emerson 2023). Spearman's correlation analysis made it possible to check whether there is a statistically significant relationship between the analyzed variables. The following ranges of correlation coefficients were adopted to assess the strength of the relationship (Guilford 1982): $|rs| = 0$ — none, $0.0 < |rs| \leq 0.1$ — slight, $0.1 < |rs| \leq 0.3$ — poor, $0.3 < |rs| \leq 0.5$ — average, $0.5 < |rs| \leq 0.7$ — high, $0.7 < |rs| \leq 0.9$ — very high, $0.9 < |rs| < 1.0$ — almost full and $|rs| = 1$ — full. Additionally, logistic regression was used in terms of a single- and multi-factor model. The values of the dependent variable indicate the presence or absence of WTP more for safety and quality of the purchased

Table 2 Demographic structure of the sample

Variable		*N*	%	Chi-square test result	H0: data is sampled from a normal distribution
Gender	Female	526	52.6	$\chi^2(1) = 2.7$; $p = 0.1$	p-value (0.1) is bigger than the significance level (0.05) so we cannot reject the null hypothesis H0 that the data tested follows a normal distribution
	Male	474	47.4		
Age	18–24	99	9.9	$\chi^2(5) = 41.17$; $p < 0.001$*	We reject H0
	25–34	194	19.4		
	35–44	205	20.5		
	45–54	161	16.1		
	55–64	169	16.9		
	65–80	172	17.1		
Place of residence	Rural areas or town up to 5.000 inhabitants	306	30.6	$\chi^2(4) = 138.56$; $p < 0.001$*	We reject H0
	City of 5.000–50.000 inhabitants	262	26.2		
	City of 50.000–200.000 inhabitants	172	17.2		
	City of 200.000–500.000 inhabitants	98	9.8		
	City of 500.000 and more	162	16.2		
Level of education	High school or lower	13	1.3	$\chi^2(3) = 631.37$; $p < 0.001$*	We reject H0
	Basic vocational education	94	9.4		
	Medium/avg. vocational/ post-secondary	454	45.4		
	Higher education	439	43.9		
Number of household members	1	93	9.3	$\chi^2(4) = 129.85$; $p < 0.001$*	We reject H0
	2	266	26.6		
	3	260	26		
	4	247	24.7		
	5 or more	134	13.4		
Self-reported material status of household	Very good	29	2.9	$\chi^2(4) = 943.25$; $p < 0.001$*	We reject H0
	Good	268	26.8		
	Average	547	54.7		
	Rather poor	126	12.6		
	Very poor	30	3		

Note: The results are statistically significant at $p < 0.05$

meat product assured with appropriate marking (Devkota et al. 2022). Then, logistic regression allows the calculation of the probability of this event (the so-called probability of success) (Huang 2022). It has been assumed that the results are statistically significant when $p < 0.05$.

The study involved 1000 randomly selected respondents aged 18–80. The largest part of the surveyed consumers were people with secondary and higher education, aged 35–44 (20.5%) and coming from a village or a small town (up to 5000 inhabitants) (30.6%). It can be assumed that the groups of men and women are equal (Table 2). The number of people in the household of the surveyed persons was not evenly distributed, which is consistent with common data for Polish households. Slightly more than half of the surveyed consumers did not have children and assessed the financial situation of their household as average.

Results

In the first step of the analysis, the Spearman rank correlation coefficient was determined for each individual item for which it was possible to assign ranks. This allowed to assess not only the strength of the relationship between the features, but also the direction of changes. In this case, the WTP feature was measured on an ordinal scale (Table 3).

Every fourth respondent does not agree to pay more for a product marked with the national food quality system (PQS, QMP, QAFP) symbol, which proves the safety and quality of the meat product. Over 70% of those sampled are willing to pay more for such a product. Most of the respondents are willing to pay slightly more for certified meat products (from 5 to 10% more).

Table 3 Measuring the willingness-to-pay a higher price for the assurance of safety and quality of the purchased meat product

How much more are you willing to pay to be sure of the safety and quality of the meat product you buy?	Number of respondents	%
I would not be willing to pay more for a product with this label	265	26.50
up to 5% more	307	30.70
From 6 to 10% more	252	25.20
From 11 to 15% more	111	11.10
From 16 to 20% więcej	43	4.30
Over 20% more	22	2.20
Sum	1000	100

Table 4 presents the results of statistical verification in terms of the existence of a statistically significant relationship between ordinal variables such as: age, place of residence, education, number of people in the household and financial situation, and declared WTP a higher price for meat product quality and safety which is confirmed by a certificate of national food quality system (measured according to the scale shown in Table 3).

The obtained results (Table 4) indicate that the consumer is willing to pay more for safety and guaranteed quality of the meat product if the consumer is characterized by the following features:

- He is younger,
- He lives in a larger town/city,
- There are more people in his household,
- He is in a better financial situation.

The strongest relationship was discovered between the number of household members and WTP for certified Polish meat products.

In order to deepen the analysis, the surveyed consumers were additionally divided into two groups:

(1) Consumers who would not be able to pay more for safety and quality of the purchased meat product assured with appropriate marking by the manufacturer/importer (n = 265),
(2) Consumers who could pay more for safety and quality of the purchased meat product assured with appropriate marking by the manufacturer/importer (n = 735).

The relationship between WTP for quality meat products and socio-demographic data was examined before the logistic regression analysis was carried out (Table 5). Chi-square test of independence and the V-Cramer coefficient was used for this purpose.

As can be seen from Table 5, the percentage share of women and men in the surveyed group of consumers is at a similar level. The same situation occurs in case of the variable of place of residence. Thus, the relationships between gender and place of residence and WTP for a certified meat product are statistically insignificant. Gender and place of residence do not affect the ability to pay for a certified meat product.

Variables such as age, number of household members and financial situation have a statistically

Table 4 The relationship between demographic factors and WTP for guaranteed quality meat products

Variable	Paying more for the assurance of safety and quality of the purchased meat product, if the manufacturer/importer would ensure this on the label with appropriate marking	Result
Age	$r_s = -0.17$; $p < 0.001$*	Significant and negative correlation; WTP more for certified meat products tends to decrease with increasing age
Place of residence	$r_s = 0.07$; $p = 0.03$*	Significant and positive correlation; WTP more for certified meat products tends to increase with increasing number of inhabitants in the place of residence
Level of education	$r_s = 0.04$; $p = 0.17$	Insignificant relationship
Number of household members	$r_s = 0.22$; $p < 0.001$*	Significant and positive correlation; WTP more for certified meat products tends to increase with growing number of household members
Self-reported material status of household *(ranked from very good to very poor)*	$r_s = -0.2$; $p < 0.001$*	Significant and negative correlation; WTP more for certified meat products tends to increase with improving self-reported material status of household

Note: A statistically significant association is discovered at $p < 0.05$. The scale measuring self-reported material status of household is reverse

significant impact on consumers' WTP for a certified meat product. The results of the study indicate that:

(1) willingness-to-pay for a certified meat product is observed among people living in households composed of 4 or more people, those with good material situation, and those aged 44 or less.
(2) lack of willingness-to-pay for a certified meat product is mainly among people living in households composed of up to 3 people, people being in a worse financial situation, people aged over 65 years.

The strongest relationship was again discovered between the number of household members and WTP for certified meat products (Table 5).

The next step in the analysis is logistic regression. It concerns the impact of socio-demographic data, i.e. gender, age, place of residence, education, number of people in the household and financial situation, on WTP for safety and quality of the purchased meat product assured with appropriate marking by the manufacturer/importer.

Table 6 contains the results of the logistic regression analysis for models with one predictor (univariate model) as well as for the model with all predictors. The material situation and the number of people in the household turned out to be statistically significant predictors in the one-factor model. WTP for safety and quality of the purchased meat product assured with appropriate marking, appears in the case of those who live in a household with 4 or more persons, as well as persons with a good/very good financial situation. Lack of consent to pay for safety and quality of the purchased meat product assured with appropriate marking, mainly concerns people living in a household of up to 3 people, people over 65 and people with a modest/very modest financial situation. The number of people in the household and the financial situation turned out to be statistically significant predictors in case of a model composed of all these factors at once (in their mutual presence).

A one-factor model that contains statistically significant predictors applies to:

Table 5 Relationship between demographic features of Polish consumers and WTP for certified meat product

Variable		Group of consumers (WTP)				Statistical test result	Result
		No		Yes			
		n	%	n	%		
Gender	Female	144	27.4	382	72.6	$\chi^2(1) = 0.44$; $p = 0.52$	Insignificant relationship
	Male	121	25.5	353	74.5		
Age	18–24	19	19.2	80	80.8	$\chi^2(5) = 13.56$; $p = 0.02$*; $V = 0.12$	Significant relationship with indistinct strength
	25–34	43	22.2	151	77.8		
	35–44	47	22.9	158	77.1		
	45–54	48	29.8	113	70.2		
	55–64	48	28.4	121	71.6		
	65–80	60	34.9	112	65.1		
Place of residence	Rural areas or town up to 5,000 inhabitants	85	27.8	221	72.2	$\chi^2(4) = 3.16$; $p = 0.53$;	Insignificant relationship
	City of 5000–50,000 inhabitants	69	26.3	193	73.7		
	City of 50,000–200,000 inhabitants	49	28.5	123	71.5		
	City of 200,000–500,000 inhabitants	19	19.4	79	80.6		
	Cty of 500,000 and more	43	26.5	119	73.5		
Level of education	High school or lower	2	15.4	11	84.6	$\chi^2(3) = 8.56$; $p = 0.04$*; $V = 0.09$	Significant relationship with indistinct strength
	Basic vocational education	36	38.3	58	61.7		
	Medium/avg. vocational/post-secondary	120	26.4	334	73.6		
	Higher education	107	24.4	332	75.6		
Number of household members	1	31	33.3	62	66.7	$\chi^2(4) = 20.96$; $p < 0.001$*; $V = 0.15$	Significant relationship with indistinct strength
	2	85	32	181	68		
	3	78	30	182	70		
	4	50	20.2	197	79.8		
	5 or more	21	15.7	113	84.3		
Self-reported material status of household	Very good	3	10.3	26	89.7	$\chi^2(4) = 16$; $p = 0.003$*; $V = 0.13$	Significant relationship with indistinct strength
	Good	57	21.3	211	78.7		
	Average	148	27.1	399	72.9		
	Rather poor	47	37.3	79	62.7		
	Very poor	10	33.3	20	66.7		

Note: A statistically significant association is discovered at $p < 0.05$

- self-reported material status of household: 1.62; 1.17–2.25 ($p = 0.003$).
- number of people in the household: 1.99; 1.46–2.71 ($p < 0.001$).
- The multi-factor model including all features also indicated that the only significant predictors were:
  - self-reported material status of household: 1.38; 0.99–1.94 ($p = 0.046$).
  - number of people in the household: 1.63; 1.09–2.43 ($p = 0.02$).

Figures 2 and 3 show, respectively, the relationship between the number of people in the household and the

Table 6 Results of the logistic regression analysis for WTP for meat products with graphic marks of national food quality systems

Variable	Odds ratio; 95% CI	
	One-factor model	Multi-factor model
Gender	1.1; 0.83–1.46 (p = 0.5)	1.18; 0.89–1.58 (p = 0.25)
Age	1.27; 0.97–1.78 (p = 0.13)	1.16; 0.86–1.66 (p = 0.33)
Place of residence	1.2; 0.87–1.68 (p = 0.26)	1.14; 0.82–1.6 (p = 0.43)
Level of education	1.22; 0.91–1.62 (p = 0.18)	1.15; 0.85–1.54 (p = 0.36)
Number of household members	1.99; 1.46–2.71 ($p < 0.001$*)	1.63; 1.09–2.43 (p = 0.02*)
Self-reported material status of household	1.62; 1.17–2.25 (p = 0.003*)	1.38; 0.99–1.94 (p = 0.046*)

Note: Predictor variables are statistically significant at $p < 0.05$

respondents' WTP more for safety and quality of the purchased meat product assured with appropriate marking, and the relationship between the declared financial situation, and declared WTP more for assured product quality.

Taking into consideration a number of household members and a financial position of a household, it turns out that a stronger predictor of WTP more for certified meat product is the number of people in the household (Fig. 2). The predictability of WTP is higher as number of people in the household increases. The chance of paying for the certainty of safety and quality of the purchased meat product, if the producer/importer would ensure it on the label with appropriate marking, increases by 1.63 times with the increase in the number of people in the household.

The financial situation of a household makes it possible to predict whether a given person will agree to pay more for certified meat product. The chance of paying more for safety and quality of meat products assured with appropriate marking, increases by 1.38 along with the improvement of the household's financial situation.

Discussion

Our study confirms that young and affluent consumers living in bigger towns or cities of Poland and staying in households made up of numerous members are more willing to pay for guaranteed quality meat products which confirms H2, H3, H5 and H6 (See Table 7 in Appendix). The strongest predictor of WTP for certified quality meat is the number of household's members which can be related to children raising and care. This is in line with the study by Tsakiridou et al. (2012) which shows that having children has a positive effect on the consumption of certified quality meat. Parents are primarily responsible for food procurement, and conventional wisdom suggests they want to ensure healthy growth and development of their children through safe and healthy food choices (Adamo & Brett. 2014). Amilien et al. (2022) reaches a similar conclusion that to some extent, choosing a product with a Food Quality Scheme (FQS) label (including the Protected Designation of Origin (PDO) and the Protected Geographical Indication (PGI)) is associated with special care for family members or guests. In our study, younger respondents (up to 44 years) are more willing to pay for certified quality meat products which is to a certain point positive because they are the decision makers of the future who make up quite large proportion of registered voters and raise children (future voters) (Kowalska et al. 2021).

Furthermore, we found out that consumers residing in bigger households and those who assess their financial situation as good or very good are significantly more able to pay more for guaranteed quality meat. Hence, H6 is also confirmed. The second strong predictor of WTP for certified quality meat products is the assessment of the household material situation. The better the situation, the more consumers are able to pay for meat with food quality and safety cues on packaging. This finding is partly consistent with those obtained by other authors, confirming a significant relationship between income and meat products purchased/consumed (Xazela et al. 2017; Mata et al. 2023); Vranken et al. (2014) suggest that consumers with higher levels of income are more aware of the impact of high red meat intake on non-communicable

Fig. 2 The relationship between the number of household members and WTP for safety and quality of meat products assured with appropriate marking

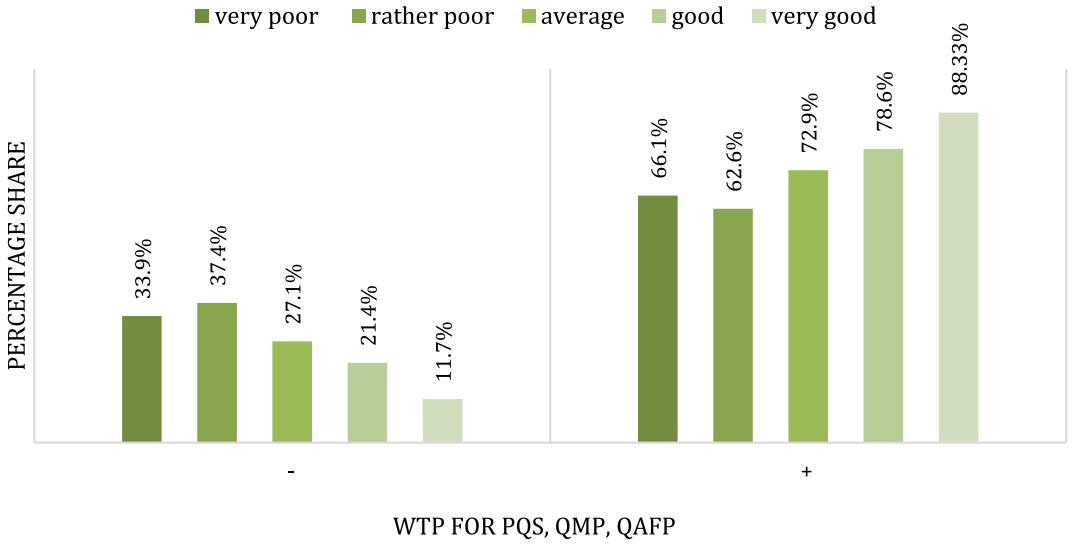

Fig. 3 The relationship between the declared financial situation and the respondents WTP safety and quality of meat products assured with appropriate marking

diseases (cardiometabolic illnesses, diverse types of cancer etc.) and the environmental impact of meat production. Thus, a choice of guaranteed quality meat products is putting into practice "less but better" meat approach which tackle sustainable challenges of meat production and consumption (Resare Sahlin & Trewern 2022). All three Polish meat quality schemes considered in our study fall within "less but better"

concept because they contribute to improved animal welfare, better human health and reduced environmental impacts.

Consumers have been paying more attention and have been giving more and more thought to their food choices across the developed world. This makes marketing messages be of particular value (Karthikeyan & Balamurugan 2012) and justifies increasing marketing expenditures and raising costs of brand creation. Creating a food product brand is closely related to certificates confirming quality, safety and/or a specific method of production. It seems that the results of our survey, that show which groups of consumers are particularly willing to pay more for certified meat products in Poland (having children and 'better off' in financial terms), could be used by food business operators from developed countries who create and then pursue their marketing strategy and adopt different marketing strategies for different markets. Credence attributes of quality food products seem to be associated with emotions and other psychological aspects, and the best brands build an emotional connection with their customers, thereby creating brand equity (Frankiewicz 2018).

Conclusion

The three national food quality systems relating to meat and meat products in Poland has the potential to contribute to achieving Sustainable Development Goals aimed at eliminating hunger and malnutrition, while protecting environment and ensuring social and economic well-being, given that food safety is a prerequisite for food security. Fulfilling the requirements of the three national food quality schemes (PQS, QMP, QAFP) translates into obtaining meat products with increased durability and culinary usefulness. As well as a unique taste, such meat produce is excellent raw material for processing (Walaszczyk 2016). These product attributes cannot be evaluated by consumers before buying it, thus, meat products labelled with PQS/QMP/QAFP logos are purchased on institutional trust (certification, logos, standards) (Manning & Kowalska 2021). Meat products which quality is assured should have a lower carbon footprint than their substitutes because of more effective traceability and labeling systems and potentially lower food losses and waste. Furthermore, it is likely that producers engaged with these quality schemes achieve higher profit margins. PQS/QMP/QAFP logos are designed to be successful marketing tools. However, previous studies revealed very little knowledge among consumers about different food quality logos and limited interest in products bearing the symbols, despite their interest in the quality of food products and the values underpinning FQSs, including, in particular, PDO and PGI (Amilien et al. 2022). Supporting domestic producers/economy is one of the values. This is positive that relatively younger and higher-income consumers living in households composed of 4 and more members are most willing to pay a premium price for guaranteed quality meat products because they and their children are the decision-makers of the future. Although, at a time of population ageing, it would be crucial to better educate older people to improve knowledge regarding food quality and safety schemes to enhance sustainable consumption. It would be worth improving dissemination of knowledge of national food quality schemes regarding meat products and this could be supported by a government strategy. Amilien et al. (2022) suggest that national contexts play a crucial role in shaping families' food practices including the engagement with food quality schemes, and this shows the added value of our research. The national culture, the most common religion food habits of various generations of people. Emerging nutrition patterns and trends create such a context. Amilien (2013) points out in her previous study that there are major differences between Southern and Northern European consumers regarding the use and knowledge about FQSs, and calls that a "silk curtain". This might be partly the result of national and EU-level policies, if appropriate, which were implemented in previous years.

One of the limitations of our study is the fact that we measured a hypothetical declaration of consumers regarding their WTP for meat products in a hypothetical situation. Thus, the results may differ from the actual decisions that consumers would make in reality. Furthermore, we surveyed only consumers of meat products with three specific food certificates (PQS, QMP, QAFP) functioning in Poland. The use of the CAWI method may seem to be a significant limitation in reaching a more diverse sample of respondents. The choice of the method was determined by the low cost of application. Another limitation is the inability to obtain data from several sources. Separating the

measurements of the independent and dependent variables significantly reduces the occurrence of common method error.

Future empirical research may address WTP for other credence attributes of food products on the market of other countries. A thorough analysis of a range of factors which influence consumers' WTP for premium quality food products might be the subject of further research.

Acknowledgements Not applicable

Authors' contributions AW. AK. IS contributed to Conceptualization; AW. IS. contributed to Methodology; AW contributed to Investigation; IS contributed to Data curation; AW. IS contributed to Visualisation; AW. AK. IS contributed to Writing; AW. AK. IS contributed to Original draft preparation; AW. AK. IS contributed to Review and editing; Supervision: AK. AW contributed to Supervision; AW. AK contributed to Project administration.

Funding Not applicable

Availability of data and materials Not applicable

Declarations

Competing interests The authors certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership. employment. consultancies. stock ownership. or other equity interest; and expert testimony or patent-licensing arrangements) or non-financial interest (such as personal or professional relationships or affiliations) in the subject matter or materials discussed in this manuscript.

Ethical approval The Lodz University of Technology in Poland has confirmed that no ethical approval is required.

Informed consent Not applicable.

Appendix

see Table 7.

Table 7 Verification of research hypotheses

Hypothesis	Verification methods used	Result
H1: There is a relationship between gender and WTP for certified Polish meat products	Chi-square test of independence (Table 2); Logistic regression (Table 6)	Rejected
H2: There is a relationship between age and WTP for certified Polish meat products	Chi-square test of independence. Cramer's V coefficient (Table 5); Spearman's R-Coefficient (Table 4); Logistic Regression (Table 6)	Confirmed
H3: There is a relationship between place of residence and WTP for certified Polish meat products	Chi-square independence test (Table 5); Logistic Regression (Table 6)	Rejected. although Spearman's R coefficient (Table 4) showed that it is related to the amount of payment
H4: There is a relationship between level of education and WTP for certified Polish meat products	Chi-square test of independence. Cramer's V coefficient (Table 5); Logistic Regression (Table 6)	Confirmed. although Spearman's R coefficient (Table 4) showed that it is not related to the amount of payment
H5: There is a relationship between number of household members and WTP for certified Polish meat products	Chi-square test of independence. Cramer's V coefficient (Table 5); Spearman's R coefficient (Table 4); Logistic Regression (Table 6)	Confirmed
H6: There is a relationship between self-reported economic status of household	Chi-square test of independence; Cramer's V coefficient (Table 5); Spearman's	Confirmed

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